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Coupling of HAWC2 and Matlab: Towards an Integrated Simulation Platform

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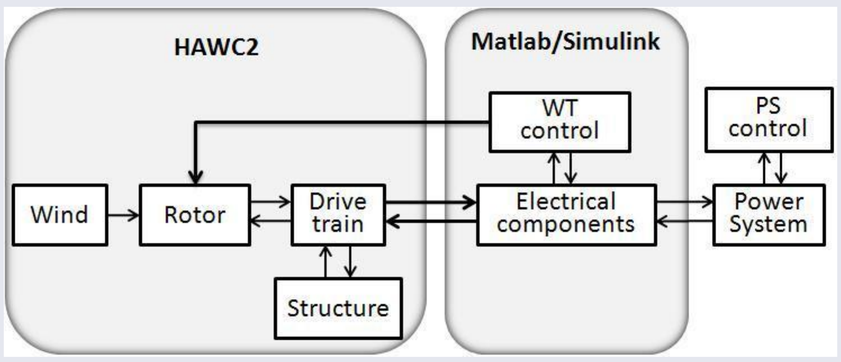
Overview

In the context of high penetration of wind energy, wind power plants will be expected to perform under uncommon situations such as: voltage faults, frequency deviations, and storms. Therefore, it is important to have a ***broad view of the design of wind turbines*** that considers the interactions amongst ***aeroelastic, structural, electrical and control systems*** of the wind turbine and the grid.

An approach towards **integrated design** of wind turbines is to develop a ***simulation platform*** that couples software dedicated to aeroelastic and structural simulations with software dedicated to control, and power system simulations. This poster presents the coupling of **HAWC2** and **Matlab/Simulink**.

HAWC2 (Horizontal Axis Wind Turbine Code) is software dedicated to aeroelastic and structural simulations of wind turbines in the time domain. HAWC2 can model aeroelastic phenomena such as: tower shadow, dynamic inflow, dynamic stall, shear effects, and induction due to large deflections.

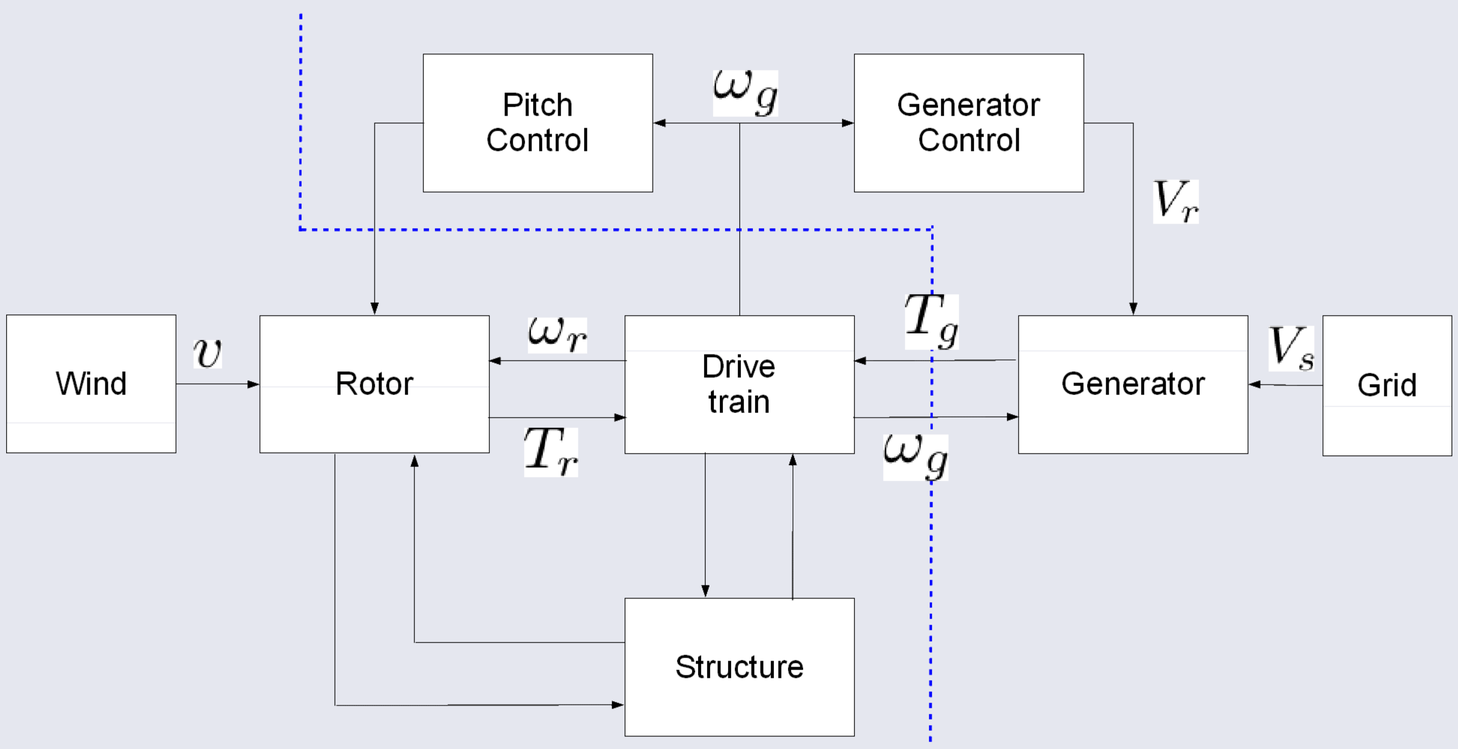
The coupling of HAWC2 and Matlab/Simulink is done through dlls and **TCP/IP** communication. Thereby keeping both applications as standalone while Matlab/Simulink manages the processes in HAWC2.



Wind turbine model

The wind turbine under study is a 2MW pitch controlled, semi-variable speed wind turbine with asynchronous generator and partial power converter

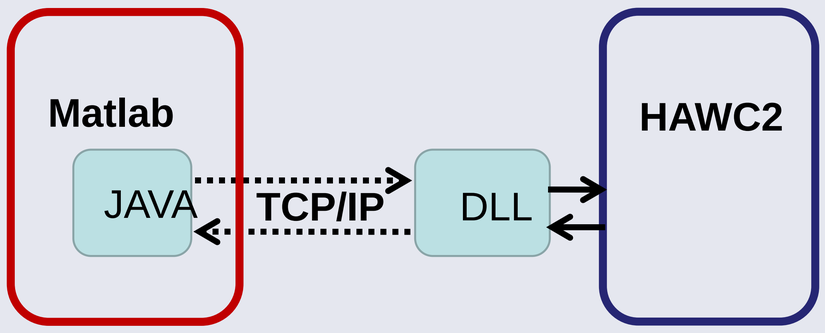
- Doubly-fed Asynchronous generator
- Generator control
- Pitch control



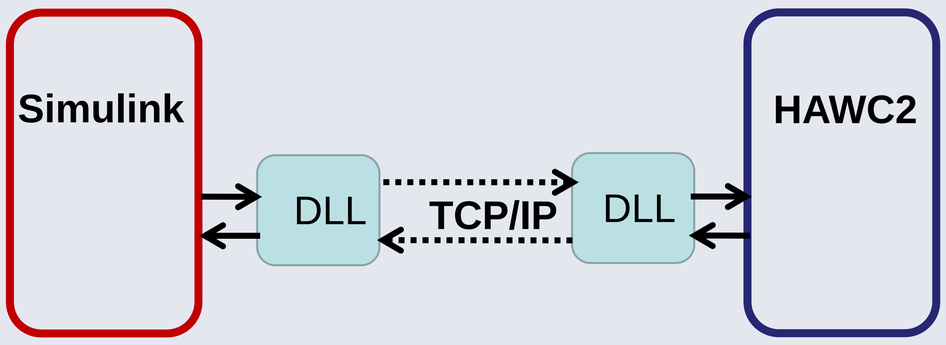
Methods

To couple HAWC2 and Matlab /Simulink keeping both applications as stand alone, the following interfaces are available:

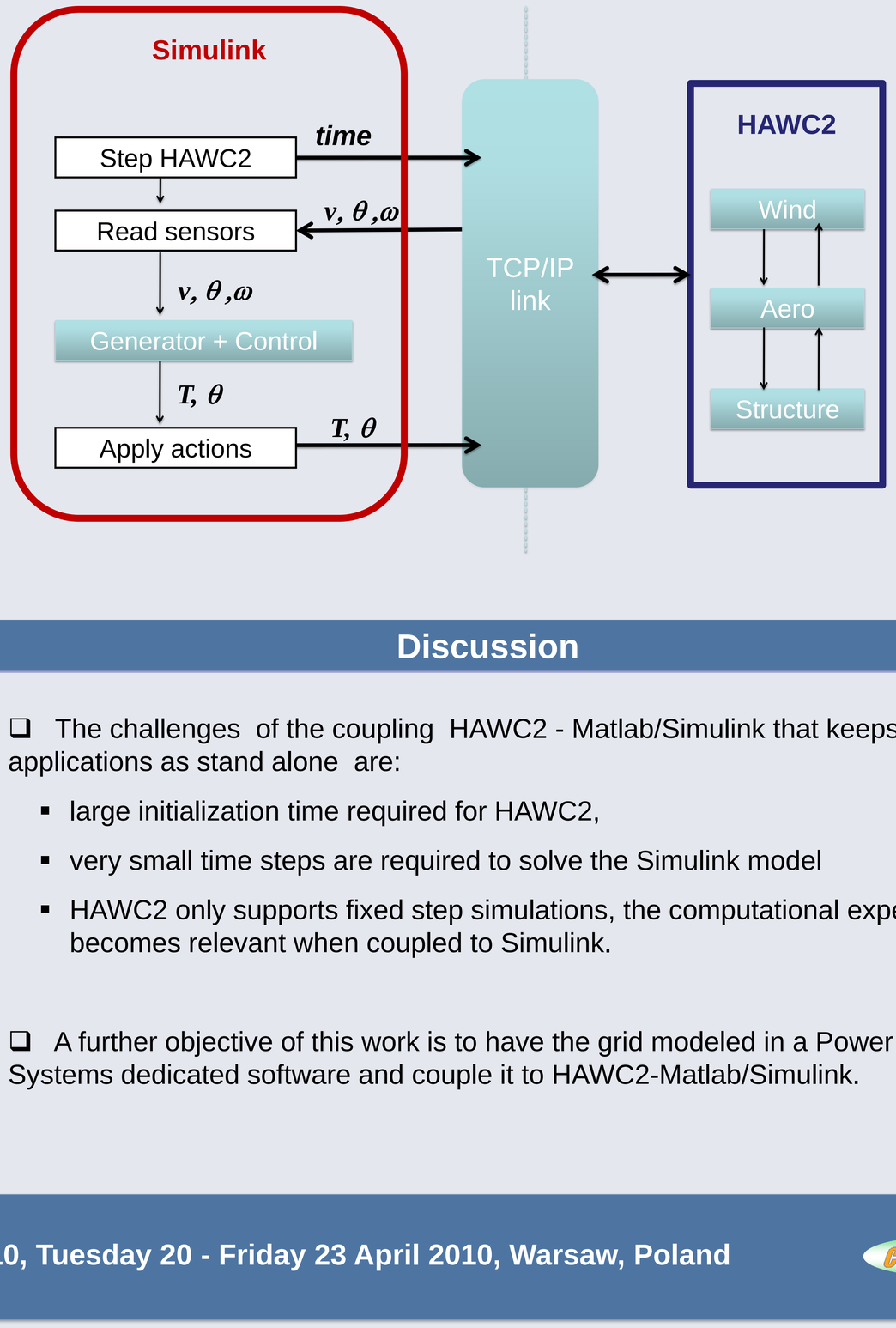
❑ **Java + TCPIP + DLL**



❑ **DLL + TCPIP + DLL**



Integrated Simulation flow chart



Discussion

❑ The challenges of the coupling HAWC2 - Matlab/Simulink that keeps both applications as stand alone are:

- large initialization time required for HAWC2,
- very small time steps are required to solve the Simulink model
- HAWC2 only supports fixed step simulations, the computational expense becomes relevant when coupled to Simulink.

❑ A further objective of this work is to have the grid modeled in a Power Systems dedicated software and couple it to HAWC2-Matlab/Simulink.